

In the late eclipse, as viewed from this station (where the sky was not only perfectly cloudless, but free from the least suspicion of haze), the obscuration of the moon was carried to a degree far beyond anything witnessed in the eclipses of recent times. For some time before and after the middle of the eclipse (that is, about 10 p.m.) the only trace of our satellite that remained in the sky was a faint dingy-brown nebulous spot, to which it was impossible to assign any definite form or dimensions, but which certainly did not approach the moon in point of apparent size. So inconspicuous was it that it was quite invisible through the window of a room in which lights were burning; and in the open air, if one had not known exactly where to look for it, one might have searched for some little time without discovering it. I speak of course of the naked-eye appearances. With an opera-glass the nebulous spot was resolved into a well-defined disk of the proper dimensions, but still very faint and dingy, the hue being a kind of reddish-brown. It was further remarked that the illumination was uniformly distributed over the disk, at least so far as this, that there was no preponderance of light in the direction of any one part of the moon's edge. This is what should naturally have followed from the central character of the eclipse, but it seems desirable to note the circumstance with reference to a theory presently to be mentioned.

The most obvious explanation of the unusual obscurity of the moon would be its unusually deep immersion in the earth's shadow, but this view seems to be clearly disproved by a comparison with the phenomena observed in a former eclipse. Referring to a note which I made at the time of the eclipse of August 23, 1877, I find the following remark:—"The moon, even in the middle of the total phase, was a conspicuous object in the sky, and the ruddy colour was well marked. In the very middle of the eclipse the degree of illumination was as nearly as possible equal all round the edge of the moon, the central parts being darker than those near the edge." Now the duration of totality in that eclipse was 1h. 44m. In the late eclipse it was 1h. 32m. The immersion of the moon in the earth's shadow must therefore, I presume, have been at least as deep on the former occasion as on the recent one. It may be mentioned as an additional argument against this explanation that in the late eclipse the visibility of the eclipsed portion was observed to be much less than usual even before the eclipse was complete. In fact it was not until within a few minutes of the total phase that the eclipsed portion could be certainly distinguished with the naked eye.

Another obvious suggestion in the way of explanation has reference to variations in the condition of that portion of the earth's atmosphere through which the sun's rays would pass to reach the moon. This explanation is not without interest in connection with the remarkable sunset effects of last winter, and, in a less degree, of the present autumn. But there are serious difficulties in the way of accepting it, for, in order to account for the observed phenomena, it would be necessary to suppose that an entire ring of the earth's atmosphere was uniformly affected. A want of uniformity in this respect would not cause merely an uneven illumination of the moon's disk, which some observers seem to have noted, and which may very well be set down to the actual differences on the surface of the moon; the effect would be specially marked upon some part of the moon's edge, and would be similar to what is observed soon after totality has commenced and shortly before it ends. Nothing approaching to this appearance was to be seen in the late eclipse at the time when the obscuration was greatest.

Is it possible that the surface of the moon may be in some small degree self-luminous, and that a variation (from unknown causes) in the degree of this self-luminosity may account for the difference observed in the

visibility of the moon in two eclipses, in both of which the solar light was equally at its minimum?

Clifton, October 7

GEORGE F. BURDER

ON the occasion of the total eclipse of the moon on Saturday, October 4, the Director of the Pulkowa Observatory, near St. Petersburg, issued a circular to a number of other observatories suggesting the use of the opportunity to fix the exact diameter of the moon, the mean value of the true diameter not being known to a second. Even as regards a probably existing depression of the surface of the moon, we know only that it cannot be very great. The circular also requested observers to watch attentively all stars, even those of the tenth magnitude, eclipsed by the moon, and their egress on the other side, which is only possible during a total eclipse. In order to make these observations exact, Prof. Döllner, of the Pulkowa Observatory, calculated the number of such stars covered by the moon on that date, which he finds were 116, most of which are of the ninth and tenth magnitude and only one of the sixth. He has, moreover, for the use of observers, calculated the exact position of these during the eclipse for no less than sixty observatories from Pulkowa to the Cape, which is expected to give the desired result.

NOTES

OUR readers will hear with sincere regret that Prof. Huxley, under the orders of his medical advisers, left England yesterday for some months of absolute rest. When it is remembered how many functions Prof. Huxley has to fulfil, we need hardly say that the cause of his enforced retirement for a time is overwork. His presence in England will certainly be missed during the coming winter, and he may feel assured that he carries with him the sympathies of many friends, known and unknown. Prof. Huxley goes in the first instance to Venice.

WE heartily support the suggestion which has been made in the *Gardeners' Chronicle* that it would be most appropriate that some memorial of the late Mr. Bentham should, subject to the consent of the authorities, be placed in the Royal Herbarium at Kew, to which he was such a benefactor, and in connection with which his life-work was for very many years carried on. Official etiquette would probably preclude any steps being taken by the authorities at Kew in the matter; and, indeed, it is a subject that would more gracefully and appropriately be dealt with by outsiders.

SIR WILLIAM HARCOURT is always happy when he touches on science, either to point a political shaft, or, as on Tuesday at Derby, when descanting directly on its progress and bearings. He showed himself well versed—as one bearing the honoured name of Harcourt ought to be—in the history of scientific progress, and in the high importance of science apart from its utilitarian uses. Scientific study, in his conception, is above all others "the most useful and the most ennobling." "Depend upon it," he concluded, "if I may turn for a moment to the utilitarian view, these are not days in which we, as a people, can afford to be idle or to be ignorant. There is an immense competition going on in the world in all departments of trade. Remember you have the competition of countries where education of this character is of a more complete character, far more complete than anything we have in this country. If you go into Germany you will find in every small town that there are institutions where the severest education is given in all departments of technical knowledge. The old days when people could afford to go on in an easy, happy-go-lucky sort of manner are gone by. You may depend upon it, in the race which we have to run in the world, a training of the severest description is requisite, so that we may hold our own." We trust Sir William will bear his admirable Derby

utterances in mind when as a legislator he has to consider the relation of science and of scientific workers to the Government and the country.

PROF. HUGO GYLDÉN, Director of the Observatory at Stockholm, and well known for his studies during recent years of the eight great planets, has been offered and has accepted the Professorship of Astronomy at the Göttingen University.

HIS MAJESTY the King of Italy has conferred the decoration of Knight of the Crown of Italy upon Deputy-Surgeon-General Francis Day, formerly Inspector-General of Fisheries in India, and lately Commissioner of the Indian Section in the great International Fisheries Exhibition.

DR. SOPHUS TROMHOLT having returned to Bergen after a lengthened sojourn in Iceland, whence we have from time to time received accounts of his researches, intends for the next few years to devote his time to the production of a great catalogue of all the auroræ seen in Northern Europe from the earliest times. The Norwegian Government have granted a not inconsiderable sum towards this gigantic undertaking. As this labour and the imminent production of his new work, "Under the Rays of the Aurora Borealis," will occupy all his time for some while, the distinguished *savant* announces his inability to issue for the coming winter such sheets for the recording of auroræ as he has for some years been in the habit of distributing over all parts of Northern Europe. He trusts, however, that observers may continue to note the phenomena as heretofore on the lines laid down by him, and forward the same to him with as little delay as possible. His address is Bergen.

CHANDA SINGH, a blind student of St. Stephen's College, Delhi, is, according to the account given in *Allen's Indian Mail*, a prodigy. He cannot read or write, but possesses such a strong memory as to be able to repeat all his text-books, English, Persian, or Urdu, by rote, and to work out sums in arithmetic with remarkable rapidity. The unusual intensity of his mental powers is shown by his ability to multiply any number of figures by another equally large. At the last University examination he was examined *viva voce* by order of the Director of Public Instruction of the Punjab, and he stood twenty-seventh in the list of successful candidates. On the recommendation of the same official, the judges of the local court have allowed him to appear at its law examination. Memory, as is well known, is wonderfully developed in Orientals, owing to the system of education which has obtained amongst them; but cases like Chanda Singh must be very rare even in the East.

DURING the last week of September the Thüringo-Saxon Verein für Erdkunde held its annual meeting at Kösen under the presidency of Herr Dunker (Halle). Amongst a number of interesting papers read we note the following:—On Baku and its naphtha and petroleum wells, by Herr Eberius (Döllnitz); on the scientific and economical importance of Cameroon, by Prof. Kirchhoff; on the limits between the High and Low German on the eastern side of the Elbe, by Dr. Haushalter (Rudolstadt); on the salt and fresh-water lakes between Halle and Eisleben, by Prof. Kirchhoff; on ancient places of worship in Northern Thuringia, by Dr. Rackwitz (Nordhausen).

THE thirty-second annual meeting of the German Geological Society took place at Hanover in the last week of September under the presidency of Herr von der Decken. Among the papers read we note the following:—On the limits of the Dyas formation, by Prof. Geinitz (Dresden); on the geology of North-Western America, by Prof. vom Rath (Bonn); on the Brachiosaurus occurring in the Hessian limestone, by Prof. Credner (Leipzig); on the geology of the Harz Mountains, by Herr Langsdorff (Klausthal); on the occurrence of dolerite in the

Vogelsberg, by Prof. Streng (Giessen); on Tasmanian tin ores, by Herr Gordaek (Klausthal); on new Devonian Bryozoa, by Dr. Bornemann (Eisenach). The next place of meeting will be Darmstadt.

WRITING on a subject of some interest at the present time, viz. the orthography of the names of the better known Chinese places, a correspondent of the *Tablettes des deux Charentes* says that *Tonquin* is more correct than *Tonkin* (and we presume also than *Tongking*, *Tonking*, &c.), for this is how the name is pronounced. He thinks that French pronunciation generally approaches that of the Chinese more than the English. Thus the Chinese have the nasal sound of *n* and a sound of *u* which we in England do not possess. We cannot always reproduce these Chinese sounds, while the French can do so easily. To represent the nasal sound the English add a *g* to the *n*, but they do not always pronounce it. The French borrow the English orthography, but they pronounce the *g* which the former have added, and thus completely disfigure the names. Thus (the correspondent goes on) the French pronounce *Shanghai* instead of *Shanghai*, and *Hongue-Kongue* in place of *Hon-Kon*. The most curious instance is that of *Canton*. The English call the province *Kwang-toung*; all the French journals follow this orthography, and yet it is Canton pure and simple. If the *k* is to be employed at all it should be written *Ton-Kien*, for we write *Fo-Kien* as the name of the province in which Foochow is situated, and the *Kien* is the same in each instance. The truth appears to be that all Far Eastern names have been transliterated haphazard, and almost in every case by people who knew nothing of the native languages. The older orthographies, such as *Canton*, *Whampoa*, &c., we owe to masters of ships, supercargoes, and the like, who visited the place in the last or beginning of the present century. In some cases they are not good attempts at reproduction, but little practical inconvenience has ever been found in adhering to them. According to the writer whom we have quoted the French are in a worse plight than ourselves; our orthography was at least an honest attempt to reproduce the names as they sounded to Englishmen. The French adopt this orthography, and then give the letters their French pronunciation; in other words the transmutation is (1) Chinese as it sounded to an Englishman; (2) that Englishman's Chinese as it sounded to a Frenchman! Little wonder then that there are hopelessly irreconcilable methods of spelling Chinese names of places.

THE Japanese Commissioner to the Health Exhibition writes that the omission of the names of the foreign authors of certain scientific works in the Japanese Section was quite unintentional. He adds that three of these works are by Japanese assistant professors. The omission, on which we commented last week in noticing the Catalogue, coupled with the statement that the English volumes were translations, was certainly calculated to leave an erroneous impression as to the authorship of the works in question.

THE second document just issued (Brockhaus, Leipzig) in connection with the "Riebeck'sche Niger Expedition," is like the first, which dealt with the Fulah language, mainly philological. The chief contents are: "Specimens of the Language of Ghât in the Sahara, with Hausa and German Translations," by the learned leader of the expedition, Herr Gottlob Adolf Krause. The Ghât being merely a variety of the Mashagh (Berber, or Western Hamitic), no special grammar was needed of a language which has already been somewhat fully elucidated by Barth, Hanoteau, Prof. Newman, and Stanhope Freeman. But these texts in the Arabic and Roman characters with interlinear German translations, and free Hausa and German versions, will be accepted as a boon by students of the languages of Sudan and North Africa. The accompanying "Anmerkungen" throw

considerable light on many obscure grammatical points, besides bringing into still closer relationship the Semitic and Hamitic groups, whose fundamental affinity is daily becoming more and more obvious. The widespread relations of what Herr Krause calls the "Haussa-Musukanische Sprach-Stamm" (Haussa-Musgu linguistic family) are also elucidated, and the curious principle of vowel harmony prevalent in this group for the first time clearly explained. It differs entirely from the Bantu, which is initial, and also from the Finno-Tatar, inasmuch as in the latter the vowels of the agglutinated postfixes conform to that of the root, which is never modified, whereas in Haussa-Musgu the root-vowel conforms to that of the postfix, and is consequently subject to constant change. Thus: *a-dara* = he loves; *e-diri-kini* = he loves you, where the preceding pronominal and root-vowel *a* has been throughout modified to *e* and *i* by the influence of the following *i* of the pronominal suffix *kini*. The introduction contains many interesting details on the history of the Ghât oasis, which most of our readers will learn for the first time was incorporated in the Turkish Empire some ten years ago. Here also some fresh light is thrown on the origin of the national or imposed names Mashagh (Imoshagh), Tuarek, Berber, Moor, Tibu, Fezzan, and Ghât. For his munificence in undertaking the publication of these "Mittheilungen" without the remotest prospect of any pecuniary returns, Dr. Emil Riebeck has earned the lasting gratitude of the scientific world.

IN the June number of *Timchri*, a journal steadily growing in scientific importance and general usefulness, the accomplished editor, Mr. E. F. Im Thurn, continues his valuable "Notes on West Indian Stone Implements." The title of these papers is now enlarged by the additional words, "and other Indian Relics," so as to include all objects, whether of stone, shell, bone, or clay, which are often found associated together in such a way as to render their separate treatment almost impossible. This enlargement of the subject cannot fail to be appreciated by ethnologists, who will here find much instructive matter lucidly arranged, and illustrated by eleven plates containing thirty-five fac-similes of stone and shell implements, and twenty-one of Carib pottery. The first group of objects belong to Sir Thomas Graham Briggs, of Barbados, who has placed his fine collection at the disposal of Mr. Im Thurn, at the same time generously providing the means for the due illustration of the series. The second group forms part of a quantity of native (Carib) pottery recently discovered on the Enmore Plantation, west coast of Demerara. The urgent necessity of encouraging collections of this sort before all have disappeared, like the natives themselves, before the advance of civilised man, is made evident by the statement that a large heap of shell implements lately found in the parish of St. James, Barbados, were carted away "to macadamise a road." Other attractive papers in this number are: "Bush-Notes of a Huntsman," by M. McTurk; "The Mountains of the West Indies," by T. P. Potter; and "Essequibo, Berbice, and Demerara under the Dutch" (continued), by the Editor.

THE following announcements are made by Mr. Edward Stanford:—"A Parliamentary County Atlas of England and Wales," containing maps of all the counties engraved on a uniform scale. This atlas includes as a distinctive feature a series of physical, statistical, and administrative maps of England and Wales and of London. The rainfall, barometric pressure, temperature of the air and of the seas around our coasts are shown for every month of the year; a river basin map, with an accompanying table giving the area of each river basin and the length of the chief water channel in each basin; an orographic map, indicating by colours the plains, hills, and mountains, with much other information of interest. A short description of each county accompanies the maps. "A Trigonometrical Survey of the Island of Cyprus," executed by command of His Excellency

Major-General Sir R. Biddulph, K.C.M.G., C.B., R.A., High Commissioner, under the direction of Major H. H. Kitchener (Captain R.E.), Director of Survey, assisted by Lieut. S. C. N. Grant, R.E. The map is drawn to a scale of one inch to one statute mile = 1 : 63,360, the scale of the Ordnance Survey of the United Kingdom; it has been engraved on fifteen copper plates, and will be printed on imperial sheets, forming, when bound, an atlas measuring 15 inches by 22 inches, or, when mounted together, one map measuring 12 feet 6 inches by 7 feet. "A School Map of British Colonies and Possessions," drawn on a uniform scale, and agreeing in style, size, and price with the other maps of Stanford's Series. Also a second and much enlarged edition of the "Geology of Weymouth, Portland, and the Coast of Dorset," with coloured geological map, section, and photographic frontispiece; "The Countries of the World," the fifth and concluding book of the Geographical Readers, by Charlotte M. Mason, containing Asia, Africa, America, and Australasia; the concluding volume of Stanford's "Compendium of Geography and Travel—Europe," by F. W. Rudler, F.G.S., and G. G. Chisholm, B.Sc., edited by Sir Andrew C. Ramsay, LL.D., F.R.S., with ethnological appendix by A. H. Keane, M.A.I., illustrated with fifteen maps and numerous cuts; "The Monuments of Athens: a Historical and Archaeological Description," by Pomagistes G. Kastromenos, translated from the Greek by Agnes Smith, author of "Glimpses of Greek Life and Scenery"; "The Visitor's Guide to Orvieto," by J. L. Bevir, M.A., Assistant Master at Wellington College.

E. AND F. N. SPON have in the press "Candles, Soap, and Glycerine," a practical treatise on the materials used and processes involved, by Mr. W. Lant Carpenter, B.Sc.; "A Text-Book of Tanning," embracing the theory and practice of preparing and dyeing all kinds of leather, by H. R. Procter, of Lowlights Tanneries, Examiner in Tanning to the Guilds Institute; "On Portable Railways," by Mr. Paul Decanville, M.I.M.E.; "History and Description of the Manchester Water-Works," by J. F. La Trobe Bateman, F.R.SS. Lond. & Edin., Past President of the Institution of Civil Engineers, F.G.S., &c.; "An Electrical Supplement to the Pocket-Book of Engineering Formulæ," by G. L. Molesworth, M.I.C.E., M.I.M.E., Consulting Engineer to the Government of India for State Railways; "On the Analysis of Iron and Steel," by T. Bayley, author of "The Chemist's Pocket-Book"; a new edition of "The Modern Practice of Sinking and Boring Wells," by Mr. Ernest Spon, Assoc. Mem. Inst. C.E.; Spon's "Mechanics' Own Book," a manual for handicraftsmen and amateurs; "Sanitary Protection," a course of lectures delivered in the Theatre of the Royal Dublin Society, 1884, by W. Kaye Parry, M.A.

PHYLLOXERA is making steady progress in the Rhenish vineyards it seems. The pernicious insect has now been found on the right bank of the river, in the vineyards of Castle Ockenfels near Linz, where over 100 acres are infected. State aid has been asked for at Berlin, as the occurrence of the pest near Linz is far more serious than that in the Ahr Valley.

A TUNNEL, measuring about 5000 feet in length, and constructed at least nine centuries before the Christian era, has just been discovered by the Governor of the island of Samos. Herodotus mentions this tunnel, which served for providing the old seaport with drinking water. It is completely preserved, and contains water tubes of about 25 centimetres in diameter, each one provided with a lateral aperture for cleansing purposes. The tunnel is not quite straight, but bent in the middle; this is hardly to be wondered at, as the ancient engineers hardly possessed measuring instruments of such precision as those constructed nowadays.

THE *Globus* reports the discovery of the ruins of an ancient city near Samarkand. They are situated upon a hill, which was

doubtless a fortress formerly. Remains of utensils and human bones have also been found. According to Arabian sources the large city of Aphrosiab existed there in the time of Moses; it was the royal residence, and the king's castle stood on the hill, and was provided with subterranean corridors. The result of the excavations show that the ruins are indeed those of a very ancient city. The various depths, however, differ widely; in the lower ones fine glass objects are found, which are quite absent from the upper ones; the lowest layers contain remains of a very primitive nature, *i.e.* coarse implements of clay and flint. The excavations are being continued. News from Turkestan announces the discovery of another ancient city, Achsy, on the right bank of the Amu Darya. Remains of brick walls and other buildings are said to be visible in considerable numbers.

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus* ♂) from India, presented by Mr. A. F. M. Smith; a Brown Capuchin (*Cebus fatuellus*) from Guiana, presented by Mr. G. S. Malet Barrow; a White-backed Piping Crow (*Gymnorhina leuconota*) from Australia, presented by Mr. F. Larkworthy; two Loggerhead Turtles (*Thalassochelys caouana*) from the Mediterranean, presented by Mr. Allan McGregor; a Common Chameleon (*Chameleon vulgaris*) from North Africa, presented by Mr. A. R. Rogers; a Horned Lizard (*Phrynosoma cornutum*) from Texas, presented by Capt. H. Mends; a Brown Mud Frog (*Pelobates fuscus*), European, presented by Mr. Claude Russell; a Sulphur-breasted Toucan (*Ramphastos carinatus*) from Mexico, a Macaque Monkey (*Macacus cynomolgus* ♂) from India, a Robben Island Snake (*Coronella phocorum*) from South Africa, deposited; a Collared Fruit Bat (*Cynonycteris collaris*), born in the Gardens.

OUR ASTRONOMICAL COLUMN

THE APPROACHING APPEARANCE OF ENCKE'S COMET.—It may be hoped that, as at the last return of this comet in 1881, an accurate ephemeris for its reappearance, which is now at hand, may be issued from the Imperial Observatory at Pulkowa. According to the mean motion, assigned by the calculations of Dr. Backlund at perihelion passage in 1881, the comet would be again in perihelion (perturbations neglected) about March 7.5 G.M.T., 1885, so that as the effect of planetary attraction will be small during the actual revolution, the comet's track in the heavens will not greatly differ from that it followed in 1852, when the perihelion passage occurred on March 14. It was first observed in that year by Dr. Vogel, at Mr. Bishop's Observatory in the Regent's Park on the evening of January 9, a refractor of 7 inches aperture being employed; at this time its distance from the sun was 1.35, and that from the earth 1.55, so that the intensity of light expressed in the usual manner was 0.23. At the return in 1875, when the perihelion passage took place on April 13, the comet was detected at the Observatory of Marseilles by M. Stephan, on the evening of January 27, distant from the sun 1.50, and from the earth 1.98, the theoretical intensity of light being therefore 0.113, or only half that at the comet's discovery in 1852. There appears to be a probability that with the large instruments now so comparatively common in observatories, the comet may be observed at a greater distance from the sun than in that year, and possibly during the absence of moonlight in November. If we assume March 7.5 for the date of perihelion passage, and bring up the longitudes in Dr. Backlund's orbit of 1881 to the beginning of 1885, we shall have the following positions of the comet at Greenwich midnight:—

1884	R.A.		N.P.D.		Distance from		Intensity of Light
	h.	m.	h.	m.	Earth	Sun	
Nov. 5	23	21	82	24	1.310	2.043	0.140
9	22	57.4	83	4	1.318	2.000	0.144
13	22	53.4	83	40	1.328	1.957	0.148
17	22	50.1	84	13	1.340	1.913	0.152
21	22	47.4	84	42	1.352	1.867	0.157
25	22	45.4	85	7	1.365	1.821	0.162

Encke did not continue the ephemeris in 1852 beyond the date of perihelion passage, but if we calculate from his elements for April 19.5 (the day of the new moon), we find the comet's place to have been in R.A. $342^{\circ} 55'$, N.P.D. $109^{\circ} 22'$, its distance from the sun 0.89, and from the earth 0.95, or the intensity of light 1.41; it would rise at the Cape about 14h. 1m., and must therefore have been readily observable. We may expect that in 1885 observations will be made in the southern hemisphere after perihelion passage.

VARIABLE STARS.—Mira Ceti is now close upon a minimum, a phase of which there are not too many observations: its magnitude is usually about 8.5 on Bessel's scale. χ Cygni will probably be at minimum about November 15: the mean of the last five periods, according to the observations of the late Prof. Julius Schmidt, is 408.2 days, and 1880 May 31.2 may be taken as a mean maximum epoch. A maximum of the fiery-looking variable R Leonis may be expected about December 10. R Leporis will probably be at minimum at the beginning of January.

SOUTHERN BINARIES.—There are two southern double-stars which appear to deserve much closer observation than they have yet received on the score of their probable binary character and rapid motion. They are:—

	R.A.	N.P.D.
	h. m. s.	° ' "
λ . 5014	17 59 22	133 24.2
λ . 5114	19 18 32	144 33.2

The positions are brought up to 1885.0 from the Paramatta Catalogue.

ON THE SEAT OF THE ELECTROMOTIVE FORCES IN THE VOLTAIC CELL

AT the Montreal meeting of the British Association a discussion on the above subject was opened by Prof. O. J. Lodge. Copies of the following notes were distributed to the members present by the opener of the discussion, together with the accompanying letter. As it has been suggested that their reproduction here would be of service, we willingly give them a place.

University College, Liverpool, July 29th, 1884

The following set of statements are privately issued by me solely with the object of securing attention to definite points in the discussion on Contact Electricity, at Montreal, which I have been instructed by the Sub-Committee to open. They are numbered for convenience of reference. I have no authority whatever for appending the names I have appended to some of the statements; and in general the whole thing is merely a statement of my own personal belief. At the same time the wording is carefully chosen and is intended to be correct in detail, and the views indicated I have held with greater or less clearness for some seven years. I should have small hesitation in believing these views to be true, were it not that I fear they are at variance with those of Sir Wm. Thomson. It is in no spirit of presumption, but simply in order more easily and distinctly to elicit the truth, that I have ventured thus to record them, and I am very willing to modify all or any of them on ground shown. It may be hoped that the discussion at Montreal will result in a substantial basis of agreement with regard to this elementary and long-debated matter. OLIVER J. LODGE

I.—ORTHODOX STATEMENTS BELIEVED BY O. J. L. TO BE TRUE IN THE FORM HERE SET DOWN

A.—Volta

1. Two metals in contact ordinarily acquire opposite charges; for instance, clean zinc receives a positive charge by contact with copper, of such a magnitude as would be otherwise produced under the same circumstances by an E.M.F. of .8 volt.

2. This apparent contact E.M.F. or "Volta force" is independent of all other metallic contacts wheresoever arranged, hence the metals can be arranged in a numerical series such that the "contact force" of any two is equal to the difference of the numbers attached to them, whether the contact be direct or through intermediate metals. But whether this series changes when the atmosphere, or medium surrounding the metal, changes is an open question: on the one side are experiments of De la Rive, Brown, Schultze-Berge; on the other side, of Pfaff, Pellat, von Zahn. It certainly changes when the free metallic surfaces are oxidised or otherwise dirty. And in general